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ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

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	Application No.	**Applicant(s)**
Office Action Summary	10/603,388	HEGDE ET AL.
	Examiner	**Art Unit**	
	Juan A. Torres	2611	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 July 2006*.

2a)☒ This action is **FINAL.** 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 July 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____ .

DETAILED ACTION

Drawings

The modifications to the drawings were received on 07/13/2006. These

modifications are accepted by the Examiner.

In view of the amendment filed on 07/13/2006, the Examiner withdraws drawing

objections of the previous Office action.

Specification

The modifications to the specification were received on 07/13/2006. These

modifications are not accepted by the Examiner.

The disclosure is objected to because of the following informalities: the recitation

in lines 8-9 of page 26 "Note that the CPI block shown in FIG. 8 operates first on the

most recent observations first (denoted as r(n+2) in FIG. 8)" is improper; it is suggested

to be change to "Note that the CPI block 300 shown in FIG. 8 operates first on the most

recent observations (denoted as r(n+1) in FIG. 7)".

Appropriate correction is required.

Claim Objections

The modifications to the specification were received on 07/13/2006. These

modifications are accepted by the Examiner.

In view of the amendment filed on 07/13/2006, the Examiner withdraws claim

objections to claims 13-15 and 18 of the previous Office action.

Response to Arguments

<u>Regarding claim 1:</u>

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "Independent claim 1 was rejected based on Chen. As described above, the Chen reference applies the List Viterbi Algorithm (LVA) to Tail-biting Convolutional coding (TCC). Chen uses the observed data to first identify one or more pairs of initial and final states. The pairs are identified using traditional decoding schemes that operate on the received data, including the Viterbi algorithm or alternative suboptimal algorithms. Chen then applies the LVA to identify a list of possible paths for each pair. The lists are then combined into a global list which is then used for decoding. The present invention, on the other hand, forms groups of sequences associated with the initial states without reference to any received data, observations, or other inputs. To clarify this aspect of the invention with respect to claim 1, the step of forming the groups of valid sequences has been amended to specify that the groups of valid sequences are "predetermined" and that the resulting groups contain "all possible valid sequences originating from the respective initial states". This step is not shown in Chen. Chen relies on Viterbi decoding or a variant thereof to identify a path for each initial/final state pair. From the pairs, the LVA algorithm is used to generate a list of alternative paths. Neither the initial paths nor the lists associated with the initial/final state pairs are predetermined lists, and neither includes all possible paths emanating from the initial state. Applicants submit that claim 1 is allowable for at least the above reasons. In addition, the claims depending from claim 1 are also in condition for allowance, as they incorporate all of the limitations of the base claim".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen discloses forming at least two predetermined groups of valid sequences, where each group is formed based on possible initial states and includes all possible valid sequences originating from respective initial states (figure 11 block 1100 column 11 line 41 to column 12 line 13. Chen select a predetermined number of groups, L from the total number of initial states 2^μ, with $L \le 2^\mu$), and include all possible valid sequences originating from the respective initial states L); receiving a set of symbol measurements (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); identifying a candidate sequence for each group of valid sequences, where the candidate sequence is a valid sequence from its respective group that is closest to the set of symbol measurements, and where each candidate sequence has corresponding decision information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13); and determining at least one output decision by selecting a group and corresponding decision information from the identified candidate sequence in response to candidate sequence selection information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13).

For these reasons and the reasons indicated in the previous Office action the rejections of claim 1 is maintained.

Regarding claim 2:

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "Further aspects of the claims depending from claim 1 warrant further discussion in light of the Examiner's rejections. In particular, claim 2 is directed to an embodiment where the candidate paths are identified by selecting sequences "in time-reverse order." This aspect of the invention is described in various parts of the specification, including paragraphs 58 and 59, beginning on page 26 of the specification. In brief, the specification describes the identification of paths through the trellis in a time-reverse manner. That is, the channel observations and the associated error metrics are examined backwards to initially identify the paths. Chen, on the other hand, traverses the trellis in the standard fashion moving forward in time, and does not disclose any type of path identification in time-reverse order. The portions of the Chen cited by the Examiner relate to "tracing back" a path that has already been identified as a survivor to determine if it has merged with other paths, thereby permitting a decision to be made regarding the earlier symbols. This is a well-known aspect of the standard Viterbi algorithm, and does not relate to the recited element of claim 2, wherein the error metrics are used to generate accumulated path errors while moving through the trellis in a time-reverse manner".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen also discloses that each candidate sequence is identified by forming a set of error metrics for each symbol in the set of received symbols, and using the sets of error metrics to select sequences having minimum accumulated errors in time-reverse order (column 1 lines 36-45, specifically, " the Viterbi decoder disregards a number of paths in the trellis and considers only the so-called surviving paths as candidates for the

best path. Looking backwards in time or "tracing back", the surviving paths tend to merge into the same predecessor path such that a decision as to the value of an earlier received symbol(s) may be made. For so-called continuous Viterbi decoding, at any point in time a decision is made as to the value of an earlier received symbol by tracing back along the path identified as the best path at that time"; column 6 lines 25-33; and column 6 line 66 to column 7 line 19).

For these reasons and the reasons indicated in the previous Office action the rejections of claim 2 is maintained.

Regarding claim 3:

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "With respect to claim 3, Chen fails to disclose the limitation: "candidate sequence selection information is fed forward from a prior output decision." As described above, Chen is directed to block decoding, and hence the decoder does not utilize prior output decisions to make decoding decisions, much less use prior outputs to select a group and its associated candidate sequence. The Examiner stated that Chen discloses feeding prior output decisions forward to select a candidate path in Figures 4 and 5, and column 6, line 46 to column 7, line 20. Applicants have reviewed this portion of Chen, and submit that this portion of Chen merely discusses standard Viterbi decoding, including such aspects as: advancing through a trellis in the forward direction ("forward processing") by updating path metrics and selecting surviving paths; identifying surviving paths by considering the initial state,

if known; truncating the decoding path by using a so-called decoding window; tracing

back along the chosen path to determine the associated symbol decision information.

None of these standard Viterbi techniques or any other content of Chen relates to

making output decisions by selecting, based on prior output decisions, one of many

previously identified candidate paths, where each of the candidate paths is associated

with an initial state".

The Examiner disagrees and asserts, that, as indicated in the previous Office

action, Chen discloses that the candidate sequence selection information is fed forward

from a prior output decision (figures 4-5;column 6 line 46 to column 7 line 20,

specifically Chen discloses that "Continuous Viterbi decoding operates on a symbol-by-

symbol basis and is used, for example, when the sequence of symbols received by the

decoder is very long. Path memory is said to be truncated to a specified length and is

referred to as a decoding window. (The length of the decoding window is generally

dependent on such factors as the channel signal-to-noise ratio ("SNR") and the so-

called code rate and code memory.) At each interval, as the decoder receives a symbol,

new surviving paths having updated path metrics are identified. One of the surviving

paths is identified as the best path. By tracing back along the best path within the

decoding window, the decoder makes a decision about the value of an earlier received

symbol--namely, the value of the symbol associated with the first branch on the best

path within the decoding window. The decoding window then slides forward one interval

and the process is repeated. Thus, using the example illustrated in FIG. 4, at interval k,

the decoder makes a decision as to the value of a symbol received $j+1$ intervals ago.

Decoding decisions made in this manner typically are satisfactory if the decoding window length is approximately five to ten times the so-called constraint length of the convolutional code").

For these reasons and the reasons indicated in the previous Office action the rejections of claim 3 is maintained.

Regarding claim 4:

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "With respect to claim 4, the claim is directed to a multistage system where each stage identifies candidate paths and makes a decision based on candidate sequence selection information, and where "the at least one output decision of each stage is provided to at least one other stage as at least a portion of the candidate sequence selection information." Chen does not show a multistage system where the decision outputs of one stage are used to select a candidate path from another stage. The sections of Chen cited by the Examiner simply relate to Chen's method of selecting pairs of states, and the performing of LVA to obtain a list of paths. Nowhere does Chen suggest that actual output decisions from one stage are used to produce output decisions from another stage".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen discloses that the recited steps are performed in each one of a plurality of parallel stages, and where the at least one output decision of each stage is provided to at least one other stage as at least a portion of the candidate sequence selection

information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13.

Chen discloses stages 1100, 1110 and 1120 and the output of each stage is inputted to

the next stage).

For these reasons and the reasons indicated in the previous Office action the

rejections of claim 4 is maintained.

Regarding claim 8:

Applicant's arguments filed on 07/13/2006 have been fully considered but they

are not persuasive.

The Applicant contends, "With respect to claim 8, Chen's passing reference to

the use of soft decision decoding does not anticipate nor render obvious the particular

use of soft information in the candidate path selection as described in claim 8".

The Examiner disagrees and asserts, that, as indicated in the previous Office

action, Chen also discloses that the step of determining at least one output decision is

performed in response to soft information (column 4 lines 38-57).

For these reasons and the reasons indicated in the previous Office action the

rejections of claim 8 is maintained.

Regarding claim 9:

Applicant's arguments filed on 07/13/2006 have been fully considered but they

are not persuasive.

The Applicant contends, "Independent claim 9 was rejected as anticipated by

Chen. Applicants submit that Chen fails to disclose the step of "forming sets of

sequential samples of symbols, wherein the sets comprise at least a first set of samples and a next set of samples".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen discloses forming sets of sequential samples of symbols, where the sets comprise at least a first set of samples and a next set of samples (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57, specifically Chen discloses that "Continuous Viterbi decoding operates on a symbol-by-symbol basis and is used, for example, when the sequence of symbols received by the decoder is very long. Path memory is said to be truncated to a specified length and is referred to as a decoding window. (The length of the decoding window is generally dependent on such factors as the channel signal-to-noise ratio ("SNR") and the so-called code rate and code memory.) At each interval, as the decoder receives a symbol, new surviving paths having updated path metrics are identified. One of the surviving paths is identified as the best path. By tracing back along the best path within the decoding window, the decoder makes a decision about the value of an earlier received symbol--namely, the value of the symbol associated with the first branch on the best path within the decoding window. The decoding window then slides forward one interval and the process is repeated. Thus, using the example illustrated in FIG. 4, at interval k, the decoder makes a decision as to the value of a symbol received j+1 intervals ago. Decoding decisions made in this manner typically are satisfactory if the decoding window length is approximately five to ten times the so-called constraint length of the convolutional code" column 6 line 46 to column 7 line 20).

The Applicant contends, "In addition, Chen fails to teach that such sets are used to determine "a plurality of minimum error paths" for the groups of paths through a trellis".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen discloses determining a plurality of minimum error paths (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13. Chen discloses a continuous Viterbi decoder in a symbol-by-symbol basic that select a plurality of minimum error path as shown in figure 11).

The Applicant contends, "Similarly, as described above with respect to claim 3, Chen does not disclose the step of selecting decision information "where the selection is based on prior state information". The citations to Chen provided by the Examiner do not disclose any selections of decision information using prior state information".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen discloses that the recited steps are performed in each one of a plurality of parallel stages, and where the at least one output decision of each stage is provided to at least one other stage as at least a portion of the candidate sequence selection information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13. Chen discloses stages 1100, 1110 and 1120 and the output of each stage is the input to the next stage).

For these reasons and the reasons indicated in the previous Office action the rejections of claim 9 is maintained.

Regarding claim 13:

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "While Liu discloses a system that uses adders, comparators and selectors to identify survivor paths, the claimed invention relates to hardware that not only identifies candidate paths but then provides those paths, and the associated decision information to a selector, the output of which is the decoding decision. Claim 13 includes a "sequence error estimator" that identifies candidate paths (and the associated decision information), and provides the decision information at "candidate path outputs" in combination with a "selector" connected to the sequence error estimator. The selector receives the "candidate path outputs" and provides one of them at its selector output, in response to a "selection input." Liu does not disclose any method or structure relating to such a selector. In particular, the selector of claim 13 has as inputs the possible decoded decision information from the candidate paths that have already been identified. The output of the selector is the decision information provided by one of the inputs. Liu does not have any selector that provides decision information at its output. Rather, the "mux" units of Liu are simply providing the path metrics of the surviving paths, not decision information".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Liu clearly discloses a selector output for providing an output decision, and a selection input for determining which of the inputs is interconnected to the selector output, thereby providing an output decision corresponding to the decision information

on the interconnected the input (section IV.B figures 31 and 32 pages 1186-1187). The

selector provided by Liu is identical to the selector claimed by the Applicants.

For these reasons and the reasons indicated in the previous Office action the

rejections of claim 13 is maintained.

Regarding claims 16 and 17:

Applicant's arguments filed on 07/13/2006 have been fully considered but they

are not persuasive.

The Applicant contends, "output decision information from a selector. Liu's

structure is used to identify survivor paths, and does not describe a selector that

receives candidate path decision information and provides an output corresponding to

one of the inputs".

The Examiner disagrees and asserts, that, as indicated in the previous Office

action, Liu clearly discloses a selector output for providing an output decision, and a

selection input for determining which of the inputs is interconnected to the selector

output, thereby providing an output decision corresponding to the decision information

on the interconnected the input (section IV.B figures 31 and 32 pages 1186-1187). The

selector provided by Liu is identical to the selector claimed by the Applicants.

For these reasons and the reasons indicated in the previous Office action the

rejections of claims 16 and 17 are maintained.

Regarding claims 14, 15 and 18-24:

Applicant's arguments filed on 07/13/2006 have been fully considered but they

are not persuasive.

The Applicant contends, "Applicants respectfully submit that independent claims 13, 16, and 17 are in condition for allowance, as are all the claims depending therefrom, including claims 14, 15, and 18-24".

The Examiner disagrees and asserts, that, because the rejection of claims 13, 16 and 17 are maintained, the rejections of claims 14, 15, and 18-24 are also maintained.

For these reasons and the reasons indicated in the previous Office action the rejections of claims 14, 15, and 18-24 are maintained.

<u>Regarding claim 25:</u>

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "With respect to independent claim 25, Applicants submit that Chen does not disclose the combination of the recited claim, which includes (i) identifying a candidate sequence for each initial state of a system having a plurality of initial states, wherein each candidate sequence has an associated candidate set of decision information', (ii) receiving initial state decision information', and (iii) selecting a single candidate set of decision information from the candidate sets in response to the received initial state information. In particular, Chen does not select a candidate sequence or associated decision information in response to the initial state information. As described above, Chen is directed to block decoding, and hence the decoder does not utilize prior output decisions to make decoding decisions, much less use prior outputs to select a group and its associated candidate Sequence".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen discloses identifying a candidate sequence for each initial state of a system having a plurality of initial states, where each candidate sequence has an associated candidate set of decision information (figure 11 block 1100 column 11 line 41 to column 12 line 13); receiving initial state decision information (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); and selecting a single candidate set of decision information from the candidate sets in response to the received initial state information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13). Chen discloses a continuous Viterbi decoder in a symbol-by-symbol basic that select a plurality of minimum error path as shown in figure 11. Chen discloses stages 1100, 1110 and 1120 and the output of each stage is the input to the next stage.

For these reasons and the reasons indicated in the previous Office action the rejections of claim 25 is maintained.

Regarding claim 26:

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "With respect to claim 26, Chen does not describe time-reverse path/sequence identification. The trace back mechanism of Chen is the well-known aspect of standard Viterbi decoding where paths that have already been identified as the "best" paths are examined to see if they all initially emerge from the

same state. Importantly, those paths were obtained through forward traversal of the trellis, not time-reverse traversal, as claimed".

The Examiner disagrees and asserts, that, as indicated in the previous Office action, Chen also discloses that each candidate sequence is identified by forming a set of error metrics for each symbol in the set of received symbols, and using the sets of error metrics to select sequences having minimum accumulated errors in time-reverse order (column 1 lines 36-45, specifically, " the Viterbi decoder disregards a number of paths in the trellis and considers only the so-called surviving paths as candidates for the best path. Looking backwards in time or "tracing back", the surviving paths tend to merge into the same predecessor path such that a decision as to the value of an earlier received symbol(s) may be made. For so-called continuous Viterbi decoding, at any point in time a decision is made as to the value of an earlier received symbol by tracing back along the path identified as the best path at that time"; column 6 lines 25-33; and column 6 line 66 to column 7 line 19).

For these reasons and the reasons indicated in the previous Office action the rejections of claim 26 is maintained.

<u>Regarding claims 27-30:</u>

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "Claims 27-30, being dependent upon claim 25, are allowable for the reasons set forth above regarding claim 25".

The Examiner disagrees and asserts, that, because the rejection of claim 25 is maintained, the rejections of claims 27-30 are also maintained.

For these reasons and the reasons indicated in the previous Office action the rejections of claims 27-30 are maintained.

Regarding claims 5, 7, 10, 12, 23, and 29:

Applicant's arguments filed on 07/13/2006 have been fully considered but they are not persuasive.

The Applicant contends, "With regard to the § 103 rejections of claims 5, 7, 10, 12, 23, and 29, Applicants have reviewed the remaining references and have not identified any material that makes up for the deficiencies with respect to the Chen and Liu references as detailed above. Therefore, Applicants submit that the remaining dependent claims are allowable for at least the reasons identified above with respect to the independent claims".

The Examiner disagrees and asserts, that, because the rejection of claims 1, 4, 9, 17 and 28 are maintained, the rejections of claims 5, 7, 10, 12, 23, and 29 are also maintained.

For these reasons and the reasons indicated in the previous Office action the rejections of claims 5, 7, 10, 12, 23, and 29 are maintained.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 6,8-9, 11, 25-28 and 30 are rejected under 35 U.S.C. 102(b) as being anticipated by Chen (US 6161210 A).

As per claim 1, Chen discloses forming at least two predetermined groups of valid sequences, where each group is formed based on possible initial states and includes all possible valid sequences originating from respective initial states (figure 11 block 1100 column 11 line 41 to column 12 line 13. Chen select a predetermined number of groups, L from the total number of initial states 2^μ, with L$\leq 2^\mu$), and include all possible valid sequences originating from the respective initial states L); receiving a set of symbol measurements (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); identifying a candidate sequence for each group of valid sequences, where the candidate sequence is a valid sequence from its respective group that is closest to the set of symbol measurements, and where each candidate sequence has corresponding decision information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13); and determining at least one output decision by selecting a group and corresponding decision information from the identified candidate sequence in response to candidate sequence selection information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13).

As per claim 2, Chen discloses claim 1, Chen also discloses that each candidate sequence is identified by forming a set of error metrics for each symbol in the set of received symbols, and using the sets of error metrics to select sequences having

minimum accumulated errors in time-reverse order (column 1 lines 36-45, specifically, "

the Viterbi decoder disregards a number of paths in the trellis and considers only the so-

called surviving paths as candidates for the best path. Looking backwards in time or

"tracing back", the surviving paths tend to merge into the same predecessor path such

that a decision as to the value of an earlier received symbol(s) may be made. For so-

called continuous Viterbi decoding, at any point in time a decision is made as to the

value of an earlier received symbol by tracing back along the path identified as the best

path at that time"; column 6 lines 25-33; and column 6 line 66 to column 7 line 19).

As per claim 3, Chen discloses claim 1, Chen also discloses that the candidate

sequence selection information is fed forward from a prior output decision (figures 4-

5;column 6 line 46 to column 7 line 20, specifically Chen discloses that "Continuous

Viterbi decoding operates on a symbol-by-symbol basis and is used, for example, when

the sequence of symbols received by the decoder is very long. Path memory is said to

be truncated to a specified length and is referred to as a decoding window. (The length

of the decoding window is generally dependent on such factors as the channel signal-

to-noise ratio ("SNR") and the so-called code rate and code memory.) At each interval,

as the decoder receives a symbol, new surviving paths having updated path metrics are

identified. One of the surviving paths is identified as the best path. By tracing back along

the best path within the decoding window, the decoder makes a decision about the

value of an earlier received symbol--namely, the value of the symbol associated with the

first branch on the best path within the decoding window. The decoding window then

slides forward one interval and the process is repeated. Thus, using the example

illustrated in FIG. 4, at interval k, the decoder makes a decision as to the value of a

symbol received j+1 intervals ago. Decoding decisions made in this manner typically are

satisfactory if the decoding window length is approximately five to ten times the so-

called constraint length of the convolutional code").

As per claim 4, Chen discloses claim 1, Chen also discloses that the recited

steps are performed in each one of a plurality of parallel stages, and where the at least

one output decision of each stage is provided to at least one other stage as at least a

portion of the candidate sequence selection information (figure 11 block 1110 path

metrics column 11 line 41 to column 12 line 13. Chen discloses stages 1100, 1110 and

1120 and the output of each stage is inputted to the next stage)

As per claim 6, Chen discloses claim 1, Chen also discloses that the groups are

formed according to possible initial states, and where each group corresponds to a

single state (figure 11 block 1100 column 11 line 41 to column 12 line 13).

As per claim 8, Chen discloses claim 1, Chen also discloses that the step of

determining at least one output decision is performed in response to soft information

(column 4 lines 38-57).

As per claim 9, Chen discloses forming groups of paths through a trellis based on

the initial states of the paths (figure 11 block 1100 column 11 line 41 to column 12 line

13); forming sets of sequential samples of symbols, where the sets comprise at least a

first set of samples and a next set of samples (column 1 lines 23-45; column 5 lines 46-

64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and

column 11 lines 17-57); for each set of samples, determining a plurality of minimum

error paths and corresponding candidate decision information, where each group has a minimum error path and corresponding candidate decision information (figure 11 block 1110 path metrics column 11 line 41 to column 12 line 13); selecting a group corresponding to the first set of samples and its minimum error path and its corresponding decision information, where the selection is based on prior state information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13); and using at least a portion of the selected corresponding decision information to select a group corresponding to the next set of samples and its corresponding decision information (figures 4-5;column 6 line 46 to column 7 line 20).

As per claim 11, Chen discloses claim 9, Chen also discloses that each group corresponds to a single possible prior state (figure 11 block 1100 column 11 line 41 to column 12 line 13)

As per claim 25, Chen discloses identifying a candidate sequence for each initial state of a system having a plurality of initial states, where each candidate sequence has an associated candidate set of decision information (figure 11 block 1100 column 11 line 41 to column 12 line 13); receiving initial state decision information (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); and selecting a single candidate set of decision information from the candidate sets in response to the received initial state information (figure 11 block 1120 first global path column 11 line 41 to column 12 line 13).

As per claim 26, Chen discloses claim 25, Chen also discloses that the candidate sequence for each initial state is identified in time-reverse order (column 1 lines 36-45; column 6 lines 25-33; and column 6 line 66 to column 7 line 19).

As per claim 27, Chen discloses claim 25, Chen also discloses that he candidate set of decision information comprises at least one data bit decision (figure 8 column 9 lines 52-65).

As per claim 28, Chen discloses claim 25, Chen also discloses that the candidate set of decision information further comprises soft decision information (column 4 lines 38-57).

As per claim 30, Chen discloses claim 25, Chen also discloses computing branch error metrics (figure 4 column 6 lines 7-24); computing and comparing path metrics (column 1 lines 23-45; column 5 lines 46-64; column 6 lines 7-24 and 46-65; column 8 lines 53-68; column 10 lines 3-9; and column 11 lines 17-57); identifying a path having the smallest path metric for each initial state (figure 11 block 1100 column 11 line 41 to column 12 line 13).

Claims 13-22 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Liu ("Algorithm-based low-power and high-performance multimedia signal processing", Proceedings of the IEEE, Volume 86, Issue 6, June 1998 Page(s): 1155 - 1202).

As per claim 13, Liu discloses at least one sequence error estimator comprising an input to receive symbol error metrics and a plurality of candidate path outputs, where the at least one sequence error estimator identifies a plurality of candidate paths and decision information corresponding to each of the candidate paths, and provides the

decision information at the candidate path outputs; a selector connected to the at least

one sequence error estimator, the selector having inputs connected to the candidate

path outputs (section IV.B figures 31 and 32 pages 1186-1187); and a selector output

for providing an output decision, and a selection input for determining which of the

inputs is interconnected to the selector output, thereby providing an output decision

corresponding to the decision information on the interconnected the input (section IV.B

figures 31 and 32 pages 1186-1187).

As per claim 14, Liu discloses claim 13, Liu also discloses that the at least one

sequence error estimator comprises a plurality of sequence error estimators, and where

at least a portion of the output decision of a first of the plurality of sequence error

estimators is provided to the selection input of another of the plurality of sequence error

estimators (section IV.B figure 32 pages 1186-1187).

As per claim 15, Liu discloses claim 13, Liu also discloses that the sequence

error estimator comprises a plurality of interconnected selectors and adders where

candidate paths are identified in time reverse order (section IV.B figures 31 and 32

pages 1186-1187).

As per claim 16, Liu discloses a branch error metric block for generating

incremental error estimates (section IV.B figures 31 and 32 page 1186 BMU); and a

plurality of candidate path identification blocks, each of the candidate path identification

blocks providing a set of outputs (section IV.B figures 31 and 32 pages 1186-1187); a

plurality of selection devices, where each one of the plurality of selection devices is

connected to the set of outputs of each one of the plurality of candidate path

identification blocks, where each selection device provides data outputs, and where the

data outputs of each of the plurality of selection devices is used to select the data

outputs of another of the plurality of selection devices (section IV.B figures 31 and 32

pages 1186-1187).

As per claim 17, Liu discloses means for generating branch error metric values

(section IV.B figures 31 and 32 page 1186 BMU); at least one decoding means

connected to the means for generating branch error metrics, where each decoding

means comprises a sequence identification means for identifying a set of candidate

sequences in response to the branch error metrics, where each candidate sequence

within the set of candidate sequences has associated candidate decision information

(section IV.B figures 31 and 32 pages 1186-1187); and a selecting means for receiving

the associated candidate decision information, and for providing output decision

information, the output decision information being generated in response to the

associated candidate decision information, and output decision information from a

selecting means of another decoding means (section IV.B figures 31 and 32 pages

1186-1187).

As per claim 18, Liu discloses claim 17, Liu also discloses that the selecting

means uses the output decision information from a selecting means of another

decoding means to select candidate decision information from one of the candidate

sequences (section IV.B figure 32 pages 1186-1187).

As per claim 19, Liu discloses claim 17, Liu also discloses that the sequence

identification means computes candidate sequences by operating in a time reverse

order (section IV.B pages 1186-1187).

As per claim 20, Liu discloses claim 17, Liu also discloses that the sequence

identification means comprises a plurality of min-select means (section IV.B figures 31

and 32 pages 1186-1187).

As per claim 21, Liu discloses claim 17, Liu also discloses that the selecting

means is a multiplexer (section IV.B figures 31 and 32 pages 1186-1187).

As per claim 22, Liu discloses claim 17, Liu also discloses that the output

decision information includes candidate decision information from one candidate

sequence within the set of candidate sequences (section IV.B pages 1186-1187

survivor memory unit).

As per claim 24, Liu discloses claim 17, Liu also discloses that the decoding

means comprises a first and a last decoding means, and where the output decision

information of the last decoding means is buffered for a first time frame and then

provided to the last decoding means in another time frame (section IV.B pages 1186-

1187 survivor memory unit).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu as
applied to claim 17 above, and further in view of Raghupathy ("A transformation for
computational latency reduction in turbo-MAP decoding", Proceedings of the 1999 IEEE
International Symposium on Circuits and Systems, 1999, ISCAS '99, Volume 4, 30 May-
2 June 1999 Page(s): 402 - 405 vol.4). Liu discloses claim 17. Liu doesn't specifically
disclose that the output decision information includes soft decision information.
Raghupathy discloses that the output decision information includes soft decision
information (abstract and introduction). Raghupathy and Liu are analogous art because
they are from the same field of endeavor. At the time of the invention, it would have
been obvious to a person of ordinary skill in the art to combine the soft decision
information disclosed by Raghupathy with the Viterbi algorithm disclosed by Liu. The
suggestion/motivation for doing so would have been to reduce the complexity of a turbo
decoder by using the Soft-Output-Viterbi-Algorithm in a iterative decoder for turbo
decoding (Raghupathy and Liu abstract and introduction). Therefore, it would have been
obvious to combine Raghupathy with Liu to obtain the invention as specified in claim 23.

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen as
applied to claim 28 above, and further in view of Raghupathy ("A transformation for
computational latency reduction in turbo-MAP decoding", Proceedings of the 1999 IEEE
International Symposium on Circuits and Systems, 1999, ISCAS '99, Volume 4, 30 May-
2 June 1999 Page(s): 402 - 405 vol.4). Chen discloses claim 28. Chen doesn't
specifically disclose that the soft decision information comprises a measure of reliability
of the at least one data bit decision. Raghupathy discloses that the soft decision

information comprises a measure of reliability of the at least one data bit decision (page

402 section 2 FPM and BPM and Log likelihood ratio). Raghupathy and Chen are

analogous art because they are from the same field of endeavor. At the time of the

invention, it would have been obvious to a person of ordinary skill in the art to combine

the reliability metric disclosed by Raghupathy with the Viterbi algorithm disclosed by

Chen. The suggestion/motivation for doing so would have been to reduce the

complexity of a turbo decoder by using the Soft-Output-Viterbi-Algorithm in a iterative

decoder for turbo decoding (Raghupathy and Liu abstract and introduction). Therefore,

it would have been obvious to combine Raghupathy with Chen to obtain the invention

as specified in claim 29.

Claims 5 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Chen as applied to claims 4 and 9 above, and further in view of Tsui (US 6070263 A).

As per claim 5, Chen discloses claim 4. Chen doesn't specifically disclose that

the respective sets of received symbols for the plurality of stages are overlapping. Tsui

discloses that the respective sets of received symbols for the plurality of stages are

overlapping (abstract, figure 4 column 3 line 62 to column 4 line 59 sa and sb are input

to compute Ms0 and Ms1). Tsui and Chen are analogous art because they are from the

same field of endeavor. At the time of the invention, it would have been obvious to a

person of ordinary skill in the art to combine the overlapping states disclosed by Tsui

with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so

would have been to reduce the power consumption (Tsui abstract and column 3 lines

62-66). Therefore, it would have been obvious to combine Tsui with Chen to obtain the invention as specified in claim 5.

As per claim 10, Chen discloses claim 9. Chen doesn't specifically disclose that a portion of the sequential samples in the first set of sequential samples is repeated in a portion of the sequential samples in the next set of sequential samples. Tsui discloses that a portion of the sequential samples in the first set of sequential samples is repeated in a portion of the sequential samples in the next set of sequential samples (abstract, figure 4 column 3 line 62 to column 4 line 59 sa and sb are input to compute Ms0 and Ms1). Tsui and Chen are analogous art because they are from the same field of endeavor. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the overlapping states disclosed by Tsui with the Viterbi algorithm disclosed by Chen. The suggestion/motivation for doing so would have been to reduce the power consumption (Tsui abstract and column 3 lines 62-66). Therefore, it would have been obvious to combine Tsui with Chen to obtain the invention as specified in claim 10.

Claims 7 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen as applied to claims 4 and 9 above, and further in view of Boo ("High-performance VLSI architecture for the Viterbi algorithm", IEEE Transactions on Communications, Volume 45, Issue 2, Feb. 1997 Page(s): 168 - 176).

As per claim 7, Chen discloses claim 1. Chen discloses that the groups are formed according to possible initial states. Chen doesn't specifically disclose that each group corresponds to a plurality of initial states. Boo discloses that each group

corresponds to a plurality of initial states (abstract, figures 1, 2 and 4b pages 169-172,

PE0 and PE1). Boo and Chen are analogous art because they are from the same field

of endeavor. At the time of the invention, it would have been obvious to a person of

ordinary skill in the art to combine the grouping using a plurality of initial states

disclosed by Boo with the Viterbi algorithm disclosed by Chen. The

suggestion/motivation for doing so would have been to improve the performance of the

Viterbi algorithm (Boo title, abstract and pages 169-172). Therefore, it would have been

obvious to combine Boo with Chen to obtain the invention as specified in claim 7.

As per claim 12, Chen discloses claim 9. Chen doesn't specifically disclose that

each group corresponds to a plurality of initial states. Boo discloses that each group

corresponds to a plurality of initial states (abstract, figures 1, 2 and 4b pages 169-172,

PE0 and PE1). Boo and Chen are analogous art because they are from the same field

of endeavor. At the time of the invention, it would have been obvious to a person of

ordinary skill in the art to combine the grouping using a plurality of initial states

disclosed by Boo with the Viterbi algorithm disclosed by Chen. The

suggestion/motivation for doing so would have been to improve the performance of the

Viterbi algorithm (Boo title, abstract and pages 169-172). Therefore, it would have been

obvious to combine Boo with Chen to obtain the invention as specified in claim 12.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Juan A. Torres whose telephone number is (571) 272-

3119. The examiner can normally be reached on Monday-Friday 9:00 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Mohammad H. Ghayour can be reached on (571) 272-3021. The fax phone

number for the organization where this application or proceeding is assigned is 571-

273-8300.

Information regarding the status of an application may be obtained from the

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USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Juan Alberto Torres
07-25-2006

TEMESGHEN GHEBRETINSAE
PRIMARY EXAMINER